APPLICATION FOR LETTERS PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

FOR:

Impact Load Transfer Element

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IMPACT LOAD TRANSFER ELEMENT

FIELD OF THE INVENTION

[0001] The present invention relates to vehicle structure, and more particularly, to a load transfer element for an improved vehicle structure.

BACKGROUND OF THE INVENTION

[0002] In vehicle design, safety and crashworthiness is increasingly important. To that end, vehicle structure and safety systems play a significant role. Modern vehicle safety systems commonly include a variety of devices such as seat belts and air bags to help protect a passenger in the event of an accident. Such systems are commonly designed to work together to improve overall vehicle safety and provide the best possible protection for vehicle occupants.

[0003] In one such safety system, a side air bag is utilized in conjunction with a seating system to protect an occupant in the event that the vehicle is struck at a side of the vehicle. In such an impact, side air bags are designed to deploy nearly instantaneously when a predetermined load is applied to the side of the vehicle to assist in the protection of the occupants. As previously discussed, safety systems such as side air bag systems commonly work in conjunction with various other safety devices. In this manner, the timing of the air bag's deployment should be controlled so as to properly function with the other safety components to yield the greatest possible protection to the occupants. Typically, the deployment of the air bag is designed to occur as soon

as possible following the initial impact to ensure that the air bag works properly with the other safety systems.

[0004] To ensure proper timing of an air bag system, an air bag sensor is typically utilized to detect a load experienced by a vehicle and to send a signal to the air bag. For a front air bag system, the air bag sensor is typically disposed near or at the front of the vehicle in a fascia or bumper in an effort to quickly sense an impact and send the proper signal to the air bag system. For a side air bag system, the air bag sensor is commonly disposed in the structure of the vehicle, generally between a front and rear door assembly, and is operable to detect a predetermined load and send a signal to the side air bag. In either of the foregoing applications, the air bag sensor detects a load applied to the vehicle and evaluates the accompanying force to determine whether or not to deploy the air bag. If the force is above a predetermined limit, the sensor will cause the air bag to deploy as soon as possible to ensure that the air bag functions properly and in conjunction with the other safety devices. If the force is below a predetermined limit, the sensor will not send a signal to the air bag and the air bag will not deploy.

[0005] As can be appreciated, deployment of an air bag can be a costly event. In this manner, air bags are commonly designed to deploy only when the sensor detects a predetermined load and to prevent deployment when the vehicle experiences a low speed impact. To prevent deployment of an air bag during a low speed impact, conventional air bag sensors are commonly disposed within a structure such that an outer structure must deform a predetermined

amount before sending a signal to an air bag sensor. In this manner, conventional systems properly protect against deployment of an air bag when the vehicle experiences a low speed impact.

[0006] While conventional systems adequately protect against deployment of an air bag under a low speed impact, such systems typically suffer from the disadvantage of causing a slight delay in the deployment of the air bag under a high speed or high load impact due to the air bag sensor being disposed within a structure of the vehicle. Specifically, as a predetermined load is required before the outer structure of a vehicle will deform and transfer an acceleration signal to the air bag sensor, a slight delay may occur between the initial impact and the deployment of the air bag due to the time in which an outer structure of the vehicle deforms enough to transfer an impact load and accompanying acceleration signal to the air bag sensor.

[0007] Therefore, a vehicle safety system that provides for immediate deployment of an air bag following a high speed or high impact event while concurrently preventing deployment of the air bag under a low speed or low impact event is desirable in the industry.

SUMMARY OF THE INVENTION

[0008] Accordingly, the present invention provides a door assembly including an inner panel, an outer panel fixedly attached to the inner panel, and a load transfer element disposed within an interstitial space formed between the inner and outer panels. The load transfer element includes a main body defining

a longitudinal axis extending from the inner panel to the outer panel and first and second reaction surfaces disposed on the main body. The first reaction surface is formed proximate the inner panel while the second reaction surface is formed generally opposite the first reaction surface and proximate the outer panel. The second reaction surface is operable to receive a load from the outer panel and to transmit the load across the main body generally along the longitudinal axis to the first reaction surface and the door inner panel. The inner panel is disposed proximate a vehicle structure, whereby the load is quickly transferred to the vehicle structure to communicate the load to a sensor disposed on the vehicle structure.

[0009] Further areas of applicability of the present invention will become apparent from the detailed description provided hereinafter. It should be understood that the detailed description and specific examples, while indicating the preferred embodiment of the invention, are intended for purposes of illustration only and are not intended to limit the scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The present invention will become more fully understood from the detailed description and the accompanying drawings.

[0011] FIG. 1 is a perspective view of a load transfer element in accordance with the principals of the present invention.

[0012] FIG. 2 is a front elevational view of the load transfer element of FIG. 1.

[0013] FIG. 3 is a side elevational view of the load transfer element of FIG. 1.

[0014] FIG. 4 is a cross-sectional view of a door assembly including a load transfer element in accordance with the principals of the present invention.

[0015] FIG. 5 is a side elevational view of the door assembly of FIG. 4.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0016] With reference to the figures, a load transfer element 10 is provided and includes a main body 12 and an attachment arm 14. The load transfer element 10 is connected to an external structure via attachment arm 14 and is operable to receive and transfer a load across the main body 12.

[0017] The main body 12 is formed from a rigid material such as, but not limited to, hard foam and the like. The main body 12 includes a top surface 16, a lower surface 18, and an arcuate surface 20. The top surface 16 includes a planar surface 22 extending between the arcuate surface 20 and a distal end 24. The lower surface 18 is formed on an opposite side of the main body 12 from

said top surface 16 and includes a planar surface 26 extending from the arcuate surface 20 to the distal end 24. The arcuate surface 20 is formed at the intersection of the top and bottom surfaces 16, 18 and includes a top portion 30 terminating at a rounded end 32, as best shown in FIG. 3.

[0018] The main body 12 further includes a longitudinal axis 34 extending between an outer end 36 and an inner end 38, as best shown in FIG. 1. The outer end 36 includes an outer engagement surface 40 and the inner end includes an inner engagement surface 42, whereby the outer engagement surface 40 is operable to receive an external force and transmit the force along the longitudinal axis 34 to the inner engagement surface 42, as will be discussed further below.

[0019] The attachment arm 14 is integrally formed with, and is offset from, the main body 12 such that main body 12 extends form the attachment arm 14, as best shown in FIG. 2. The attachment arm includes an upper portion 44 and a lower portion 46, whereby each of the upper and lower portions 44, 46 extend from the main body 12 in opposite directions. The upper portion 44 includes a proximate end 48 disposed at the junction of the main body 12 and a distal end 50 having an arcuate surface 52. In addition, the upper portion 44 includes a planar surface 54 extending between the proximate and distal ends 48, 50 on a first side 56 and includes a planar surface 58 formed on a second side 60, as best shown FIG. 2. The second side 60 extends from the attachment arm 14 for aid in attachment, as will be discussed further below.

[0020] The lower portion 46 includes a proximate end 62 disposed at the junction between the lower portion 46 and the bottom surface 18 of the main body 12 and a distal end 64 extending generally away from the bottom surface 18, as best shown in FIGS. 2 and 3. The planar surface 54 extends from the first portion 44 generally over the second portion 46 on a first side 66 of the lower portion 46 while a planar surface 68 extends from a second side 70 of the lower portion 46 for aid in attachment, as will be discussed further below. In addition, a clearance space 72 is created between the bottom surface 18 of the main body 12 and the first side 66 of the lower portion 46, as best shown in FIG. 2.

[0021] With reference to FIGS. 4-5, the operation of the load transfer element 10 will be described in detail. The load transfer element 10 is shown incorporated into a door assembly 76 of a vehicle 78. The vehicle 78 includes a structural pillar 80 while the door assembly 76 includes an inner panel 82 and an outer panel 84. The inner panel 82 is fixedly attached to the outer panel 84 and is fixedly attached thereto such that an interstitial space 86 is created therebetween. In addition, the inner and outer panels 82, 84 overlap the structural pillar 80 such that the inner panel 82 is proximate the structural pillar 80 when the door is in a closed position.

[0022] The load transfer element 10 is disposed in the interstitial space 86 of the door assembly 76 and is fixedly attached to the inner panel 82. Specifically, the planar surface 58 of the upper portion 44 and the planar surface 68 of the lower portion 46 are fixedly attached to the inner panel 82 by a fastener such as a structural adhesive 83. In this manner, the inner engagement surface

42 abuts the inner panel 82 while the outer engagement surface 40 is disposed proximate the outer panel 84. It should be understood that while a structural adhesive is disclosed, any suitable fastener, such as a mechanical fastener, is anticipated and should be considered as part of the present invention.

[0023] In the event that the vehicle 78 is struck from the side such that a force is imparted on the outer panel 84 of the door assembly 76, the load transfer element 10 is operable to transfer the load from the outer panel 84 to the inner panel 82 and structural pillar 80. Specifically, when the outer panel 84 experiences a predetermined load, the outer panel 84 will deflect, thereby contacting the outer engagement surface 40 of the main body 12. Once the outer panel 84 deflects sufficiently, the force is transmitted to the inner engagement surface 42 and inner panel 82 along the longitudinal axis 34.

[0024] By way of example, in a pole impact situation or simulated test, the load transfer element 10 is operable to receive a concentrated load from a pole 90. As pole 90 impacts and deflects outer panel 84, outer panel 84 contacts outer engagement surface 40 of load transfer element 10. This impact load is transferred through main body 12 to door inner panel 82 along longitudinal axis 34. As can be appreciated, the main body 12 ensures that the load will be transferred along the longitudinal axis 34 very quickly as the outer panel 84 only has to deflect a small amount prior to contacting the outer engagement surface 40. In this manner, the load applied to the outer panel 84 is transferred to inner panel 82 and structural pillar 80 almost immediately after the initial impact.

[0025] As the load transfer element 10 is disposed within the interstitial space 86 generally at a point at which the inner and outer panels 82, 84 overlap the structural pillar 80, the load transferred to the inner panel 82 will be immediately transferred to the structural pillar 80. In this regard, the load will reach the structural pillar 80 much quicker after the initial impact due to the interaction of the load transfer element 10, the door assembly 76, and the structural pillar 80.

[0026] In a vehicle 76 having a side air bag system (not shown), an air bag sensor 88 is commonly used to quickly detect a side impact load. Sensor 88 is located on the structural pillar 80, as shown in Figure 5. As can be appreciated, it is desirable to have an air bag deploy as soon as possible following an impact to provide the best possible protection for vehicle occupants. In such a system, the load transfer element 10 acts to more quickly transfer an impact load from the outer panel 84 to the structural pillar 80. In this regard, the contact between the inner panel 82 and structural pillar 80, via the outer panel 84 and load transfer element 10, will trigger the air bag sensor 88 much sooner after the initial impact, thereby allowing a signal to be sent to an air bag very quickly. Without the use of the load transfer element 10, the impact load is not effectively transferred from the outer panel 84 to the inner panel 82 until outer panel 84 is deflected through the interstitial space 86 and into contact with inner panel 82. The impact load is then transferred from inner panel 82 to structural pillar 80 and sensor 88, signaling a side impact air bag to fire. This extended sequence increases the time between initial impact and deployment of the air bag.

[0027] As previously discussed, an air bag system is designed to operate only when a predetermined impact load is exerted on the vehicle. This is generally accomplished through an air bag control system receiving an acceleration signal from sensor 88. In this regard, the air bag should fire when the impact load creates a sufficient acceleration signal, but not otherwise. To accommodate this condition, the load transfer element 10 allows a low force of a predetermined magnitude to contact the outer panel 84 without the air bag sensor 88 sending a sufficient acceleration signal to deploy the air bag. Specifically, the load transfer element 10 allows the outer panel 84 to deflect into the clearance space 72 generally below the main body 12 such that the low impact force will not transfer through the main body 12 along the longitudinal axis 34. In this manner, the load transfer element 10 prevents the low impact force from reaching the inner panel 82 and structural pillar 80, thereby preventing a sufficient acceleration signal from being sent to the air bag sensor 88.

[0028] The load transfer element 10 accommodates a low speed impact, such as those experienced in a simulated low speed impact by an FMVSS 214 barrier 92, by allowing the barrier 92 to contact the outer panel 84 at a location generally below the bottom surface 18 of the main body 12 and within clearance space 72, as best shown in FIG. 5. In this manner, a low impact force may be applied to the outer panel 84 without causing the force to be transmitted to the structural pillar 80. Specifically, as the outer panel 84 deflects, the outer engagement surface 40 will remain unaffected as the barrier 92 imparts the force generally below the main body 12 of the load transfer element 10. In this

manner, the load transfer element 10 provides for near immediate transmission of a high impact force to the air bag sensor 88 while concurrently preventing a low speed or low impact force from reaching the sensor 88. In this regard, the load transfer element 10 is operable to reduce the time to fire for a side air bag while preventing unwanted and unnecessary deployment of the air bag in a low speed event.

[0029] The description of the invention is merely exemplary in nature and, thus, variations that do not depart from the gist of the invention are intended to be within the scope of the invention. Such variations are not to be regarded as a departure from the spirit and scope of the invention.